

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: )  
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Yamazaki et al. )  
)  
Serial No.: )  
)  
Filed: Herewith )  
)  
For: Semiconductor Device Provided With )  
Semiconductor Circuit Made of )  
Semiconductor Element and Method Of )  
The Same )  
)  
Examiner: )  
)  
Art Unit: )

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Signature Ruben M. Gomez

March 28, 2001

Assistant Commissioner for Patents  
Washington D.C. 20231

PRELIMINARY AMENDMENT A

Prior to examination, please enter the following amendment in the above-identified application:

IN THE CLAIMS:

Please cancel Claims 1-28.

Please add the following new claims:

-- 29. A method of fabricating an EL display device, said method comprising the steps of:  
forming a gate wiring on an insulating surface;  
forming a gate insulating film and an initial semiconductor film into a laminate sequentially without exposing them to an atmosphere on the gate wiring;

irradiating the initial semiconductor film with an infrared light or an ultraviolet light to crystallize the initial semiconductor film into a crystalline semiconductor film and to form an oxide film at a same time;

covering a first portion of the crystalline semiconductor film with a mask;

providing a trivalent or pentavalent impurity element into second portions of the crystalline semiconductor film through the oxide film,

wherein the first portion of the crystalline semiconductor film is a channel forming region while the second portions of the crystalline semiconductor film are source and drain regions.--

-- 30. A method according to claim 29,

wherein contaminants on a surface of the gate insulating film are reduced by active hydrogen or hydrogen compound before forming the initial semiconductor film.--

-- 31. A method according to claim 29, further comprising a step of forming a silicon nitride film before forming the gate insulating film.--

-- 32. A method according to claim 29, further comprising a step of forming a laminate film including BCB (benzocyclobutene) as a part of the gate insulating film.--

-- 33. A method according to claim 29,

wherein the gate insulating film, the initial semiconductor film and the oxide film are formed in a same chamber.--

-- 34. A method of fabricating an EL device, said method comprising the steps of:

forming a gate wiring on an insulating surface;

forming a gate insulating film, an initial semiconductor film, and an insulating film into a laminate sequentially without exposing them to an atmosphere on the gate wiring;

irradiating the initial semiconductor film with an infrared light or an ultraviolet light to crystallize the initial semiconductor film into a crystalline semiconductor film;

covering a first portion of the crystalline semiconductor film with a mask;

providing a trivalent or pentavalent impurity element into second portions of the crystalline semiconductor film through the insulating film,

wherein the first portion of the crystalline semiconductor film is a channel forming region while the second portions of the crystalline semiconductor film are source and drain regions.--

-- 35. A method according to claim 34,

wherein the gate insulating film, the initial semiconductor film, and the insulating film are formed in a same chamber.--

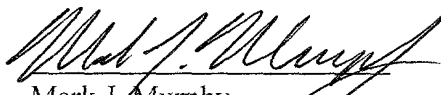
-- 36. A method according to claim 34,

wherein contaminants on a surface of the gate insulating film are reduced by active hydrogen or hydrogen compound before forming the initial semiconductor film.--

-- 37. A method according to claim 34, further comprising a step of forming a silicon nitride film before forming the gate insulating film.--

-- 38. A method according to claims 34, further comprising a step of forming a laminate film including BCB (benzocyclobutene) as a part of the gate insulating film.--

Respectfully submitted,

  
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16. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element, comprising:  
forming a gate wiring over a substrate;  
sequentially forming a gate insulating film, a semiconductor film and a second insulating film over said gate wiring and the substrate without exposing to the air;  
crystallizing said semiconductor film by irradiating the semiconductor film through said second insulating film with light to obtain a crystalline semiconductor film;  
patterning said crystalline semiconductor film and said second insulating film to form a protective film and an active layer an end face of which is flush with an end face of said protective film; and  
covering with a mask a region to be a channel formation region of said active layer, and adding through said protective film impurity elements that give N type or P type conductivity.

17. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element, comprising:  
forming a gate wiring over a substrate;  
sequentially forming a gate insulating film, a semiconductor film and a second insulating film over said gate wiring and the substrate without exposing to the air;  
crystallizing said semiconductor film by irradiating the semiconductor film through said second insulating film with infrared light or ultraviolet light to obtain a crystalline semiconductor film;  
covering with a mask a region to be a channel formation region of said crystalline semiconductor film, and adding through said second insulating film impurity elements that give N type or P type conductivity;  
patterning said second insulating film to form a protective film; and  
patterning said crystalline semiconductor film to form an active layer an end face of which is flush with an end face of said protective film.

18. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element, comprising:  
forming a gate wiring over a substrate;  
sequentially forming a gate insulating film, a semiconductor film and a second insulating film over said gate wiring and the substrate without exposing to the air;  
crystallizing said semiconductor film by irradiating the semiconductor film through said second insulating film with infrared light or ultraviolet light to obtain a crystalline semiconductor film;  
patterning said crystalline semiconductor film and said second insulating film to form a protective film and an active layer an end face of which is flush with an end face of said protective film;  
covering with a first mask a region to be a channel formation region of said active layer, and adding through said protective film impurity elements that give N type or P type conductivity;

and

adding with the use of a second mask impurity elements that give N type or P type conductivity in a region to be a source region or a drain region of said active layer.

19. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element, comprising:

forming a gate wiring over a substrate;

sequentially forming a gate insulating film, a semiconductor film and a second insulating film over said gate wiring and the substrate without exposing to the air;

crystallizing said semiconductor film by irradiating the semiconductor film through said second insulating film with infrared light or ultraviolet light to obtain a crystalline semiconductor film;

patterning said crystalline semiconductor film and said second insulating film to form a protective film and an active layer an end face of which is flush with an end face of said protective film;

covering with a first mask a region to be a channel formation region of said active layer, and adding through said protective film impurity elements that give N type or P type conductivity;

adding with the use of a second mask impurity elements that give N type or P type conductivity in a region to be a source region or a drain region of said active layer; and

removing said first mask and said second mask at once.

20. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element, comprising:

forming a gate wiring over a substrate;

sequentially forming a gate insulating film, a semiconductor film and a second insulating film over said gate wiring and the substrate without exposing to the air;

crystallizing said semiconductor film by irradiating the semiconductor film through said second insulating film with infrared light or ultraviolet light to obtain a crystalline semiconductor film;

covering with a first mask a region to be a channel formation region of said crystalline semiconductor film, and adding through said second insulating film impurity elements that give N type or P type conductivity;

adding with the use of a second mask impurity elements that give N type or P type conductivity in a region to be a source region or a drain region of said crystalline semiconductor film;

patterning said second insulating film to form a protective film; and

patterning said crystalline semiconductor film to form an active layer an end face of which is flush with an end face of said protective film.

21. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element, comprising:

forming a gate wiring over a substrate;

sequentially forming a gate insulating film, a semiconductor film and a second insulating

film over said gate wiring and the substrate without exposing to the air;

crystallizing said semiconductor film by irradiating the semiconductor film through said second insulating film with infrared light or ultraviolet light to obtain a crystalline semiconductor film;

covering with a first mask a region to be a channel formation region of said crystalline semiconductor film, and adding through said second insulating film impurity elements that give N type or P type conductivity;

adding with the use of a second mask impurity elements that give N type or P type conductivity in a region to be a source region or a drain region of said crystalline semiconductor film;

removing said first mask and said second mask at once;

patterning said second insulating film to form a protective film; and

patterning said crystalline semiconductor film to form an active layer an end face of which is flush with an end face of said protective film.

22. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element of claim 16, wherein said light is infrared light or ultraviolet light.

23. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element of claim 22, wherein said infrared light is an infrared laser light.

24. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element of claim 22, wherein said infrared light is an infrared lamp.

25. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element of claim 22, wherein said ultraviolet light is an excimer laser light.

26. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element of claim 22, wherein said ultraviolet light is an ultraviolet lamp.

27. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 18, wherein said first mask is a resist mask formed by irradiating the back surface of said substrate with light.

28. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 16, wherein said gate insulating film, said initial semiconductor film and said protective film are formed respectively using chambers different from one another.

29. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 16, wherein said gate insulating film and said protective film are formed using a first chamber, and said initial semiconductor film is formed using a second chamber.

30. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 16, wherein said method further comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a silicon nitride film.

31. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 16, wherein said method further comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a BCB (benzocyclobutene) film.

32. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 16, wherein said semiconductor device is an electro-optical device or an electronic equipment.

33. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element of claim 32, wherein said electro-optical device is a liquid crystal display device, an EL display device, an EC display device or an image sensor.

34. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 19, wherein said first mask is a resist mask formed by irradiating the back surface of said substrate with light.

35. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 20, wherein said first mask is a resist mask formed by irradiating the back surface of said substrate with light.

36. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 21, wherein said first mask is a resist mask formed by irradiating the back surface of said substrate with light.

37. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 17, wherein said gate insulating film, said initial semiconductor film and said protective film are formed respectively using chambers different from one another.

38. A method of manufacturing a semiconductor device provided with a

semiconductor circuit comprising a semiconductor element as claimed in claim 18, wherein said gate insulating film, said initial semiconductor film and said protective film are formed respectively using chambers different from one another.

39. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 19, wherein said gate insulating film, said initial semiconductor film and said protective film are formed respectively using chambers different from one another.

40. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 20, wherein said gate insulating film, said initial semiconductor film and said protective film are formed respectively using chambers different from one another.

41. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 21, wherein said gate insulating film, said initial semiconductor film and said protective film are formed respectively using chambers different from one another.

42. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 17, wherein said gate insulating film, and said protective film are formed using a first chamber, and said initial semiconductor film is formed using a second chamber.

43. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 18, wherein said gate insulating film, and said protective film are formed using a first chamber, and said initial semiconductor film is formed using a second chamber.

44. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 19, wherein said gate insulating film, and said protective film are formed using a first chamber, and said initial semiconductor film is formed using a second chamber.

45. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 20, wherein said gate insulating film, and said protective film are formed using a first chamber, and said initial semiconductor film is formed using a second chamber.

46. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 21, wherein said gate insulating film, and said protective film are formed using a first chamber, and said initial semiconductor film is formed using a second chamber.



47. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 17, wherein said method comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a silicon nitride film.

48. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 18, wherein said method comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a silicon nitride film.

49. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 19, wherein said method comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a silicon nitride film.

50. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 20, wherein said method comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a silicon nitride film.

51. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 21, wherein said method comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a silicon nitride film.

52. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 17, wherein said method further comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a BAB (benzocyclobutene) film.

53. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 18, wherein said method further comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a BAB (benzocyclobutene) film.

54. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 19, wherein said method further comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a BAB (benzocyclobutene) film.

55. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 20, wherein said method further comprises a step of forming as said gate insulating film a laminated film including,

among other layers, one layer of a BAB (benzocyclobutene) film.

56. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 21, wherein said method further comprises a step of forming as said gate insulating film a laminated film including, among other layers, one layer of a BAB (benzocyclobutene) film.

57. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 17, wherein said semiconductor is an electro-optical device or an electronic equipment.

58. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 18, wherein said semiconductor is an electro-optical device or an electronic equipment.

59. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 19, wherein said semiconductor is an electro-optical device or an electronic equipment.

60. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 20, wherein said semiconductor is an electro-optical device or an electronic equipment.

61. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 21, wherein said semiconductor is an electro-optical device or an electronic equipment.

62. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 57, wherein said electro-optical device is a liquid crystal display device, an EL display device, an EC display device or an image sensor.

63. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 58, wherein said electro-optical device is a liquid crystal display device, an EL display device, an EC display device or an image sensor.

64. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 59, wherein said electro-optical device is a liquid crystal display device, an EL display device, an EC display device or an image sensor.

65. A method of manufacturing a semiconductor device provided with a semiconductor

circuit comprising a semiconductor element as claimed in claim 60, wherein said electro-optical device is a liquid crystal display device, an EL display device, an EC display device or an image sensor.

66. A method of manufacturing a semiconductor device provided with a semiconductor circuit comprising a semiconductor element as claimed in claim 61, wherein said electro-optical device is a liquid crystal display device, an EL display device, an EC display device or an image sensor.